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THE PHILIPPINE
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No. 3

ON A COLLECTION OF STOMATOPOD CRUSTACEA FROM THE
PHILIPPINE ISLANDS

By STANLEY KEMP

(Assistant Superintendent, Indian Museum, Calcutta, India)

ONE PLATE

The collection of Stomatopoda sent to me for examination by the zoological department, University of the Philippines, is an extremely interesting one. In addition to examples of a species hitherto undescribed, it contains a number of scarce and imperfectly known forms and enables considerable additions to be made to our knowledge of the geographical distribution of some members of the order.

In all, 20 species and 2 varieties of Stomatopoda are now known from the Philippine Islands, namely:

<i>Squilla scorpio</i> Latreille.	<i>Lysiosquilla multifasciata</i> Wood-Mason.
<i>Squilla leptosquilla</i> Brooks.	<i>Lysiosquilla vicina</i> Nobili.
<i>Squilla hieroglyphica</i> Kemp.	<i>Gonodactylus chiragra</i> (Fabricius).
<i>Squilla oratoria</i> De Haan.	<i>Gonodactylus chiragra</i> var. <i>platysoma</i> Wood-Mason.
<i>Squilla oratoria</i> var. <i>perpensa</i> Kemp.	<i>Gonodactylus demani</i> Henderson.
<i>Squilla nepa</i> Latreille (Bigelow).	<i>Gonodactylus glabrous</i> Brooks.
<i>Squilla raphidea</i> Fabricius.	<i>Gonodactylus proximus</i> sp. nov.
<i>Pseudosquilla ciliata</i> (Fabricius).	<i>Gonodactylus glaber</i> Lenz.
<i>Pseudosquilla ornata</i> Miers.	<i>Gonodactylus glyptocercus</i> Wood-Mason.
<i>Pseudosquilla megalophthalma</i> Bigelow.	<i>Gonodactylus spinosissimus</i> Pfeffer.
<i>Lysiosquilla maculata</i> (Fabricius).	
<i>Lysiosquilla acanthocarpus</i> Miers.	

All of these species, with the exception of *Squilla leptosquilla* and *oratoria*, sensu stricto, are present in the collection before me. The former was obtained by the Challenger Expedition in the vicinity of the Philippine Islands at a depth of 115 fathoms, while of the latter a single somewhat abnormal specimen, col-

lected in the Philippines by H. J. Veitch, is preserved in the British Museum collection.

For the new species the name *Gonodactylus proximus* is suggested. It belongs to a group of five very closely allied forms, the characters of which I have discussed in some detail. Owing to the kindness of Dr. W. T. Calman I am able to give some further particulars, which I believe will be welcome, regarding the structure of *G. tuberosus*, a species briefly described by Pocock from the China seas.

Of *Squilla hieroglyphica*, represented in the collection by a single example, only one specimen of unknown locality has previously been recorded. *Pseudosquilla megalophthalma* was hitherto known only from the Red Sea and Mauritius and *Gonodactylus spinosissimus* only from the Red Sea, Zanzibar, and off Ceylon. If my identification is correct *Gonodactylus glaber* must also extend far to the east of the localities in which it has previously been found. *Lysiosquilla vicina*, a most interesting species, which like its near relative in California seems to inhabit burrows made by *Balanoglossus*, has hitherto been known only from Nobili's mutilated type specimen taken in the Red Sea. *Lysiosquilla multifasciata*, another scarce form, is represented in the collection by a series of nine specimens which illustrate the manner in which the characteristic pigmentation is developed.

I have to express my best thanks to Dr. R. P. Cowles, of the University of the Philippines, for the opportunity of examining this interesting collection.

STOMATOPODA

Genus *SQUILLA* Fabricius

Squilla scorpio Latreille.

Squilla scorpio KEMP, Mem. Ind. Mus. (1913), 4, 42, Pl. II, fig. 30.
No. 0-133. Bantayan, Cebu Province, 1909, 2 ♂, 83 mm.

The two individuals are adult males; the carinæ of the last abdominal somite and telson and the bases of the primary teeth of the latter are strongly inflated, while the raptorial claws exhibit the characteristic features of the sex. The specimens seem to have deteriorated somewhat in alcohol, and unlike much older examples in the Indian Museum collection, the black patch on either side of the fifth thoracic somite, mentioned in Latreille's original description, is scarcely visible; the other characters, however, clearly indicate that the specimens must be referred to the typical form and not to the variety *immaculata*.

Squilla hieroglyphica Kemp.

Squilla hieroglyphica KEMP, Mem. Ind. Mus. (1913), 4, 51, Pl. III, figs. 38-41.

No. 0-341. Herran Street Market, Manila, Luzon, December, 1911, 1 ♀, 48 mm.

This species appears to be very scarce and has hitherto been known only from a single example of unknown origin in the Indian Museum collection.

The specimen from the Philippines differs in some respects from the type, but may undoubtedly be referred to the same species.

The rostrum is about as long as wide, but is much broader apically than in the type, and there are fewer spines on the abdominal carinæ, namely:

Carinæ.	Abdominal somites.
Submedian	6
Intermediate	5, 6
Lateral	5, 6
Marginal	2, 3, 4, 5

On the telson there are traces of a prælateral denticle, and between the primary marginal spines there are 4 submedian denticles, 7 or 8 intermediate, and 1 lateral. As in the type specimen the raptorial claw bears 5 slender teeth, including the terminal one, and there is no trace of the mandibular palp.

The entire surface of the specimen is curiously eroded. This I believe to be due to the action of formalin, and the same cause may also account for the fact that the curious patches of black pigment, found on the telson of the type specimen, are here entirely missing.

Squilla oratoria De Haan var. *perpensa* Kemp.

Squilla oratoria var. *perpensa* KEMP, Mem. Ind. Mus. (1913), 4, 70, Pl. V, figs. 57-59.

No. 0-100. Manila Bay, Luzon, 1910, 1 ♂, 83 mm. No. 0-341. Herran Street Market, Manila, Luzon, December, 1911, 2 ♂, 1 ♀, 61-62 mm.

Except for the fact that in one specimen the anterior bifurcated portion of the median carina of the carapace is semi-obsolete, the specimens are quite typical of this widely distributed form.

Squilla oratoria, sensu stricto, is apparently restricted to more northern waters, although I have myself examined a single rather aberrant example from the Philippines which is preserved in the British Museum. The variety *perpensa* is recorded from an area ranging from Hongkong and N. Australia to the Persian Gulf.

Squilla nepa Latreille (Bigelow).

Squilla nepa KEMP, Mem. Ind. Mus. (1913), 4, 60, Pl. IV, fig. 49.

No. 0-100. Manila Bay, Luzon, 1910, 2 ♀, 117, 136 mm. No. 0-105. Manila Bay, Luzon, June, 1911, 2 ♀, 142, 147 mm. No. 0-106. Manila Bay, Luzon, December, 1911, 1 ♀, 98 mm. No. 0-118. Divisoria Market, Manila, Luzon (*T. Banguis*), Nov. 22, 1911, 1 ♀, 160 mm. No. 0-120. Divisoria Market, Manila, Luzon (*T. Banguis*), Nov. 10, 1911, 2 ♀, 93, 120 mm. No. 0-121. Herran Street Market, Manila, Luzon, 1911, 1 ♀, 98 mm.

In one specimen (No. 0-100) the arms of the anterior bifurcation of the median carina of the carapace, instead of being separated throughout their length, are joined together in front of the small middorsal pit. Otherwise all the specimens are quite typical.

Squilla raphidea Fabricius.

Squilla raphidea KEMP, Mem. Ind. Mus. (1913), 4, 88, Pl. VII, fig. 77.

No. 0-111. Divisoria Market, Manila, Luzon (*T. Banguis*), Nov. 22, 1911, 1 ♀, 160 mm.

Genus PSEUDOSQUILLA Dana**Pseudosquilla ciliata** (Fabricius).

Pseudosquilla ciliata KEMP, Mem. Ind. Mus. (1913), 4, 96.

No. 0-313. Port Galera, Mindoro (*Cowles*), April 20, 1912, 1 ♀, 75 mm.

Pseudosquilla ornata Miers.

Pseudosquilla ornata KEMP, Mem. Ind. Mus. (1913), 4, 100.

No. 0-659. Port Galera, Mindoro, 70 fms. (*Cowles*), April 20, 1912, 1 juv., 22 mm.

The specimen is not in good condition. According to the label the color in life was "red with a brown tinge and with cream-colored dots and cream-colored bars transversely on carapace and on telson extending on to uropods." A pair of dark eyespots circumscribed by a paler shade can be detected on the carapace.

Apart from the fact that the rostrum is rather more sharply pointed apically and that the submedian carinæ of the telson are not fully formed, there is no structural difference between this specimen and the examples in the Indian Museum.

Pseudosquilla megalophthalma Bigelow. Plate I, fig. 1.

Pseudosquilla megalophthalma BIGELOW, Proc. U. S. Nat. Mus. (1894), 17, 500; NOBILI, Ann. Sci. Nat. Zool. (9) (1906), 4, 336; KEMP, Mem. Ind. Mus. (1913), 4, 103.

No. 0-654. Port Galera, Mindoro (*Cowles*), June 3, 1912, 1 ♂, 38 mm.

The single specimen of this scarce species agrees closely in structure with Bigelow's detailed description; but as in Nobili's examples from the Red Sea, spines are found at the postero-lateral angles of only the last 3 abdominal somites, and there is no additional spine on the sixth somite on the inner side of the large intermediate spine. The external spine of the bifurcate process of the uropods is a trifle longer than the inner, though the difference between the two is not nearly so pronounced as in *P. ornata*. In this respect the specimen agrees with the type; in the examples from the Red Sea the two spines are equal in length.

The eyes are noticeably larger proportionately than in the allied species, and the ocular somite terminates anteriorly in a sharp spine, which is visible between the bases of the eyestalks. The dorsal process of the basal segment of the antennal protopodite is longitudinally channeled above, while the inferior blade of the process (which is T-shaped in section) is not concave in lateral view; the process, in fact, is precisely similar to that found in *P. ornata*.

The lateral truncate margin of the sixth thoracic somite is more definitely sinuous than in *P. ornata* or *P. oculata* and the >-shaped groove on the lateral wall of the first abdominal somite is well defined.

The color, well preserved in the Philippine specimen, is very characteristic (Plate I, fig. 1). In place of the pair of eyespots found on the carapace in *P. ornata*, *P. oculata*, and *P. oxyrhyncha* there is in the present species a single median spot, black, circular, and circumscribed by pale yellow. The ground color of the specimen is dull maroon brown (probably much brighter in life) with numerous small cream-colored spots faintly circumscribed by dark brown. These spots, which show a tendency toward arrangement in transverse rows, are found in the posterior third of the carapace, on the exposed thoracic somites, and on all the abdominal segments except the last. The postero-lateral corner of the fifth abdominal somite is black, the area so colored being separated from the other parts of the somite by a well-defined band of yellow. The posterior edge of the last abdominal somite with the apices of its spines is blackish, and between this border and the brown anterior portion of the somite a narrow yellow band intervenes. The telson is blackish with traces of a transverse yellow band in its middle; the bases of each of the primary teeth are also yellow in color. The uropods are conspicuously banded with yellow.

Pseudosquilla megalophthalma, specimens of which I have not hitherto had an opportunity of examining, belongs to a small group of very closely allied species which are somewhat difficult to determine with any facility. Apart from color, which in this case is very characteristic, *P. megalophthalma* may be distinguished from its allies by the form of the rostrum, the length of the spines forming the bifurcate process of the uropods, and in particular by the presence and position of the first lateral carina of the telson. This carina in *P. megalophthalma* runs to the apex of the lateral tooth of the telson margin, whereas in *P. oculata* it terminates behind the base of the intermediate marginal tooth. In *P. ciliata*, *P. ornata*, and *P. oxyrhyncha*, the other three species comprised in this group, the first lateral carina is wholly absent.

Genus **LYSIOSQUILLA** Dana

Lysiosquilla maculata (Fabricius).

Lysiosquilla maculata KEMP, Mem. Ind. Mus. (1913), 4, 111, Pl. VIII, figs. 86-91.

No. 0-362. No locality given, 1 ♀, 125 mm. No. 0-1108. Taytay, Palawan, "Coll. by natives," May 24, 1913, 1 ♀, 235 mm. No. 0-1109. Taytay, Palawan, "Coll. by natives," June 4, 1913, 1 ♀, 280 mm.

In the two very large females the teeth on the raptorial claws are, as is usual, very short and less numerous than in males. In specimen 0-1108 there are respectively 8 and 9, and in specimen 0-1109, 7 and 9. On these limbs there are tufts of hairs on the carpus and at the base of the propodus.

In the small specimen the left hand claw, as in the male, bears 10 slender teeth including the terminal one, while on the right propodus, which is smaller and appears to have been regenerated, there are only 9 teeth.

In the two individuals in which the color is preserved the dark patch on the telson extends middorsally to the distal margin, isolating an oval, pale area on either side. On the middle of the last abdominal somite there is in one specimen a large transverse pale patch; this segment, as a rule, is wholly pigmented.

Lysiosquilla acanthocarpus Miers.

Lysiosquilla acanthocarpus KEMP, Mem. Ind. Mus. (1913), 4, 120.

No. 0-329. Bantayan, Cebu Province, 1 ♀, 66 mm.

The specimen has been preserved in formalin, and no trace of its original color remains.

Lysiosquilla multifasciata Wood-Mason. Plate I, figs. 2, 3.

Lysiosquilla multifasciata WOOD-MASON, Figs. and Desc. of nine Squillidae (1895), 1, Pl. I, figs. 4-7; KEMP, Mem. Ind. Mus. (1913), 4, 122.

Nos. 0-831 and 0-840. Port Galera, Mindoro, "Dug while hunting *Balanoglossus* near camp." (Griffin and Wharton), June 13, 1912, 7 ♂, 2 ♀, 28-56 mm.

This scarce species is represented in the collection by 9 specimens of various ages, which are particularly interesting in that they show the manner in which the dark pigment pattern, which is such a characteristic feature of this and of most other species of *Lysiosquilla*, is developed.

In young specimens, 28 to 32 millimeters in length, there is far less pigment than in adults, that on the exposed thoracic somites being limited to a median patch with a blotch on either side, while on each of the first 5 abdominal somites there are 2 short transverse streaks in the middle and 4 or 5 isolated patches and streaks on either side. On the sixth somite there is a somewhat indefinite transverse patch on either side and on the telson a patch involving the bases of the 2 outer spines of the dorsal series and the lateral marginal teeth (Plate I, fig. 2).

At a later stage, in specimens 40 and 42 millimeters in length, the various patches have almost completely joined, the narrow anterior transverse band of the abdominal somites being, however, distinctly separated from the broader posterior band (Plate I, fig. 3).

The coloring of the adults differs but slightly from that of the type specimen described by Wood-Mason. The amount of pigmentation on the rostrum is decidedly variable, and as a rule, there is in the anterior two thirds of the carapace only a single large indefinite pigmented patch which does not extend to the lateral margins; it is rarely possible to distinguish 2 separate transverse bands in this region. There is always a very heavy transverse border to the posterior margin of the carapace.

On the exposed thoracic somites, in place of the 2 bands found in the type specimen, there is, in adults, only a single band placed posteriorly. Double transverse bands occur on each of the first 5 abdominal somites, the 2 bands being connected mid-dorsally by a suffusion of pigment.

The telson, the coloration of which could not be distinctly made out in the type specimen, exhibits dorsally a single large, semicircular, dark patch extending posteriorly to the base of the marginal teeth and denticles, but in the middle of its distal

edge deeply emarginate, leaving the whole of the base of the middle tooth of the dorsal series pale.

In regard to structural features it may be mentioned that young males invariably possess 6 teeth on the raptorial claw, the posterior one being very small and lying close against the next of the series. In all the other larger specimens there are only 5 teeth. The penultimate tooth is invariably shorter than the antepenultimate, and the large angular lobe at the base of the dactylus on its outer side—one of the most characteristic features of the species—is well shown in all the specimens. In the middle of the distal margin of the telson, between the movable submedian denticles, there are 3 or 4 pairs of spinules.

There are no marked structural distinctions between adult males and females.

Lysiosquilla vicina Nobili. Plate I, figs. 4-8.

Lysiosquilla vicina NOBILI, Bull. Mus. Hist. Nat. (1904), 10, 229; NOBILI, Ann. Sci. Nat. Zool. (9) (1906), 4, 339; KEMP, Mem. Ind. Mus. (1913), 4, 126.

No. 0-840. Port Galera, Mindoro, "Dug while hunting *Balanoglossus* near camp." (Griffin and Wharton), June 13, 1912, 2 ♂, 29 and 32 mm.

In the same bottle with the specimens of *L. multifasciata* were 2 examples of this species, hitherto known only from a single mutilated individual obtained in the Red Sea. These specimens have enabled me to supplement Nobili's account in several particulars and to supply figures of the species.

The rostrum (fig. 5) is one and a half times as broad as long and is remarkable for the fact that it terminates anteriorly in 3 spines, a character found only in one other species of the genus: namely, *L. digueti* Coutière. The median spine extends little beyond those at the lateral angles and fails to reach the cornea of the eye. The anterior margin on either side of the median spine is deeply concave. In dorsal view the spines of the antennular somite are completely concealed by the rostrum.

The eyes are short and rather broad; the cornea is not definitely divided into 2 lobes and is hardly wider than the stalk.

The antennular peduncle extends beyond the eye by the length of its distal segment. The antennal peduncle scarcely reaches the end of the eyestalks. As in *L. multifasciata* and several other species of the genus the antennal protopodite bears on its ventral surface a single soft elongated papilla.

The mandibular palp is composed of 3 segments.

The raptorial claw (fig. 6) somewhat resembles that of *L. tigrina* and is much more slender than that of *L. multifasciata*.

The outer inferior margin of the merus is prominently angulate anteriorly, and the carpus bears a single sharp dorsal spine close to the distal margin; at the base of the pectinate margin of the propodus are 4 comparatively large movable spines. The dactylus is provided with 10 or 11 teeth (usually 10) including the terminal one. Of these the penultimate is equal in length to, or very slightly shorter than, the antepenultimate. The outer margin is evenly convex, and at its base there are 2 small lobes of which the proximal is subacute and the distal bluntly rounded.

In the last 3 thoracic limbs the ultimate segment of the shorter ramus is elongate-oval on the appendage of the eighth somite and almost circular on those of the sixth and seventh.

On its dorsal side the sixth abdominal somite is produced at either posterolateral angle to a stout tooth, and on the inferior aspect there is a slender falcate spine situated anterolaterally on either side and projecting downward, curving round the basal segment of the uropods. There are no ventral spines on the posterior margin of the somite.

The telson (fig. 7) is semicircular in shape and bears a dorsal series of 5 sharp teeth arranged in a curved transverse row. Beyond the outermost of these teeth there is, on each side, a small and inconspicuous tubercle. The posterior margin is armed, as described by Nobili, with 4 large teeth on either side, the lateral much the largest, the remainder more or less equal in size. Immediately beneath each submedian tooth is a large movable denticle, and between the two are 8 pairs (6 pairs in the type specimen according to Nobili) of small spinules, those of each side being arranged in a curved row around the base of the fixed submedian tooth so that the median pair is situated on the same level as that tooth (fig. 8). In the interspaces between the 3 lateral teeth, and on a lower level, a single denticle is to be found, while in front of the lateral tooth there is a prominent angular lobe on the same level as the denticles.

The basal segment of the uropods is prominently keeled externally and bears a sharp dorsal tooth at its posterior angle. Inferiorly the bifurcate process consists of 2 long spines, the outer two thirds the length of the inner; there is also a small spinule over the attachment of the endopod. The proximal segment of the exopod bears 5 or 6 movable spines on its external margin. In the endopod, as is usual in the group to which the species belongs, the anteroexternal margin is folded over and lies firmly pressed against the dorsal surface.

The coloration is distinctive (fig. 4). The rostrum, eyestalks, antennæ, antennular peduncle, and most of the thoracic ap-

pendages are sprinkled with large, black chromatophores. The carapace is similarly pigmented, the pigment spots toward the posterior end showing a tendency toward aggregation into a transverse band. Each of the last 3 thoracic and first 5 abdominal somites bears a narrow posterior band, which in the case of the abdominal somites is sometimes interrupted in the middle. In the median portion of each somite there are also 2 other narrow bands of pigment, distinctly separated in the middle, but always joined laterally. There are thus in this species 3 distinct bands on each somite in place of the 1 or 2 found in allied forms. On the sixth abdominal somite there is a single large, round, dusky patch on either side. On the telson, much as in *L. multifasciata*, a patch of black pigment invests the bases of the 2 outermost pairs of the dorsal series of teeth; the base of the median tooth is pale, and there is also a pale intrusion between the first and second lateral teeth. The uropods are suffused with black pigment at the proximal end of the basal segment, on the endopod, and on the joint between the 2 segments composing the exopod.

Lysiosquilla vicina is very closely allied to *L. digueti* Coutière, from Lower California, and these 2 species may be distinguished from all other members of the genus by the possession of a trispinous rostrum.

Judging from Coutière's account¹ of the American species, the two forms may be separated as follows:

<i>Lysiosquilla vicina</i> Nobili.	<i>Lysiosquilla digueti</i> Coutière.
Raptorial claw furnished with 10 or 11 teeth.	Raptorial claw furnished with 8 teeth.
Telson with 6 to 8 pairs of submedian denticles.	Telson with 3 pairs of submedian denticles.
No eyespots on fifth abdominal somite or telson.	A pair of very prominent black spots, pale in the center and circumscribed by a pale band on fifth abdominal somite, and a pair of similar spots partially fused on telson.

Lysiosquilla digueti, like *L. vicina*, inhabits burrows made by *Balanoglossus*, and the only specimen known was found living commensally with a large polynoïd worm in the tubular cavity formed by the genital ridges of the *Balanoglossus*. The stomatopod was found in this curious situation fixed to the back of the polynoïd. The two commensals resembled one another closely in color, the conspicuous patches of pigment on the *Lysiosquilla*

¹ Coutière, *Bull. Soc. philomath.*, Paris (9) (1905), 7, 174.

bearing a striking similarity to those on the elytra of the polynoid.²

Genus GONODACTYLUS Latreille

Gonodactylus chiragra (Fabricius).

Gonodactylus chiragra KEMP, Mem. Ind. Mus. (1913), 4, 155, Pl. IX, fig. 107.

No. 0-338. Port Galera, Mindoro (*Cowles*), March 30, 1912, 1 ♂, 33 mm. (form AD); 1 ♀, 71 mm. (form A). No. 0-347. Bantayan, Cebu Province, 1909, 1 ♂, 110 mm. (form AB); 1 ♀, 91 mm. (form A). No. 0-651. B 30-58. Port Galera, Mindoro, 45 ft. (*Cowles*), April 21, 1912, 1 ♀, 14.5 mm (form H). No. 0-656. Medio Island, Port Galera, Mindoro (*Cowles*), April 4, 1912, 1 ♀, 28 mm. (form H). No. 0-653. D4. Port Galera, Mindoro (*Cowles*), April 11, 1912, 1 ♂, 1 ♀, 13.5 and 18 mm. (form H). No. 0-657. B 51. Port Galera, Mindoro, 10 ft. (*Cowles*), April 20, 1912, 1 ♀, 17 mm. (form H). No. 0-658. C 32. Port Galera, Mindoro (*Seale*), April 11, 1912, 2 juv. 8 and 9 mm. (form H). No. 0-660. A 51. Port Galera, Mindoro, 70 ft. (*Cowles*), April 20, 1912, 1 ♂, 14 mm. (form H). No. 0-661. B 30-58. Port Galera, Mindoro, 45 ft. (*Cowles*), April 21, 1912, 1 ♂, 16 mm. (form H). No. 0-662. West coast of Paniguian Island, Port Galera, Mindoro (*Griffin*), March 30, 1912, 2 ♀, 26 and 31 mm. (form H). No. 0-663. A 51. Port Galera, Mindoro, 70 ft. (*Cowles*), April 20, 1912, 1 ♂, 16 mm. (form H). No. 0-664. A 51. Port Galera, Mindoro, 70 ft., 1 ♂, 16.5 mm. (form H). No. 0-666. Port Galera, Mindoro, 70 ft. (*Cowles*), April 20, 1912, 1 ♀, 28 mm. (form H). No. 0-858. Port Galera, Mindoro (*Cowles*), May 19, 1912, 4 ♂, 2 ♀, 73-89 mm. (form A). No. 0-1035. Taytay, Palawan (*Laki*), April or May, 1913, 2 ♂, 3 ♀, 44-94 mm. (4 form A, 1 form AH). No. 0-1057. Taytay, Palawan (*Cowles*), April 11, 1913, 1 ♀, 65 mm. (form A). No. 0-1061. Taytay, Palawan (*Laki*), April 17, 1913, 1 ♂, 78 mm. (form A). No. 0-1079. Pabellones Island, Palawan (*Laki*), May, 1913, 2 ♀, 18 and 43 mm. (form D). No. 0-1094. Batas Island (*Wharton*), May 15, 1913, 1 ♀, 77 mm. (form A). No. 0-1095. Taytay, Palawan (*Laki*), April 17, 1913, 1 ♂, 77 mm. (form A). No. 0-1096. Taytay, Palawan (*Cowles*), April 21, 1913, 1 ♀, 57 mm. (form D). No. 0-1097. Taytay, Palawan (*Ricardo*), May 23, 1913, 1 ♂, 1 ♀, 77 and 99 mm. (form A). No. 0-1113. Taytay, Palawan (*Laki*), April 20, 1913, 1 ♀, 76 mm. (form A). No. 0-1114. Taytay, Palawan (*Griffin*), April 15, 1913, 1 ♀, 53 mm. (form D).

Examination of the long series of specimens in the collection of the zoölogical department of the University of the Philippines tends to confirm the views which I expressed when giving an account of the material in the Indian Museum: namely, that of all the varieties which have been recognized by distinct names only one, variety *platysoma* Wood-Mason (with which form G = *acutus* Lanchester is apparently synonymous), can be sustained.

All of the specimens listed above, in my opinion, are examples of *Gonodactylus chiragra*, sensu stricto. Under the records of

² See Coutière, loc. cit.

occurrence I have endeavored to indicate the form which the telson has assumed in each batch of specimens, using the initial letters given by Borradaile in his key to the "varieties" of the species.³

As in the Indian Museum collection, the majority of the larger specimens are to be referred to form A (= *incipiens* Lanchester). There are a few examples of form D (= *smithi* Pocock), while most of the very small individuals, of which there is a large series, represent form H (= *affinis* de Man). In a number of the very smallest examples, somewhat doubtfully referred to this last form, the median carina of the telson is very broad and exhibits on either side near its distal extremity a small dimple or longitudinal depression. This depression appears to become larger in the course of subsequent molts, and in time results in the formation of the short additional carina typical of form H.

In my account of the Indian material I have suggested that the characters of specimens of form H become modified in the course of subsequent molts. Throughout the Stomatopoda there is a tendency for the carinæ of the telson to become blunter with age, and when this is borne in mind it is not difficult to understand how a specimen which started life as form H may, with increased size, take on the characters of form A.

The coloration of the smaller specimens is, in many cases, noted in detail on the labels, and the range of variation in this respect is evidently very great. Most specimens appear to have been spotted or banded with cream on a ground color of red, reddish brown, brown, gray, or yellowish green.

Gonodactylus chiragra var. *platysoma* Wood-Mason.

Gonodactylus chiragra var. *platysoma* KEMP, Mem. Ind. Mus. (1913), 4, 162, text fig.

No. 0-858. Port Galera, Mindoro (*Cowles*), May 19, 1912, 5 ♂, 1 ♀, 72-91 mm. Nos. 0-1011 and 0-1012. Guam, Mariana Islands (*Thompson*), 1913, 1 ♂, 71 mm., 1 ♀, 64 mm. No. 0-1107. Medio Island, Port Galera, Mindoro (*Cowles*), April 20, 1913, 1 ♀, 58 mm.

The specimens agree closely with the examples in the Indian Museum and resemble them in being noticeably broader in proportion than typical examples of the species. In describing the Indian Museum specimens I attempted to demonstrate this difference mathematically, but one of the measurements used on that occasion, namely, the total length including rostrum, is perhaps liable to give somewhat inaccurate results owing to varying degrees of contraction or expansion in the preserved material.

³ Borradaile, *Trans. Linn. Soc. Zool.* (1907), 12 (2), 211.

In the case of the Philippine examples of this variety, therefore, I have attempted to express this difference in the form of a ratio between the length of the carapace (excluding rostrum) and the breadth of the abdomen at the fourth abdominal somite. The results seem to indicate that the variety is on the average broader than the typical form in the proportion of 6 to 5.

TABLE I.—Measurements of *Gonodactylus chiragra* var. *platysoma*.

No.	Sex.	Total length.	Length of carapace.	Breadth of fourth abdominal somite.	Ratio of carapace-length to abdomen-breadth.
		mm.	mm.	mm.	
0-858	♂	91	18.4	17.3	1.06
0-858	♂	84	17.4	16.6	1.05
0-858	♂	84	17.1	16.3	1.05
0-858	♂	81	16.7	16.1	1.04
0-858	♂	72	15.1	14.8	1.02
0-1011	♂	71	15.5	14.2	1.09
0-858	♀	76	16.3	16.2	1.01
0-1012	♀	64	14.0	14.1	0.99
0-1107	♀	58	12.0	12.5	0.96

TABLE II.—Measurements of *Gonodactylus chiragra*, *sensu stricto*.

No.	Sex.	Total length.	Length of carapace.	Breadth of fourth abdominal somite.	Ratio of carapace-length to abdomen-breadth.
		mm.	mm.	mm.	
0-347	♂	110	26.8	21.2	1.26
0-858	♂	89	19.2	15.2	1.26
0-1061	♂	73	18.0	14.7	1.22
0-1095	♂	77	16.7	14.0	1.19
0-1097	♂	77	16.2	13.5	1.20
0-858	♂	76	16.5	13.4	1.23
0-858	♂	75	16.5	13.5	1.22
0-858	♂	73	14.3	11.7	1.22
0-1035	♂	48	10.8	8.0	1.35
0-1035	♂	44	10.0	7.7	1.30
0-1097	♀	99	20.1	16.5	1.22
0-1035	♀	94	20.5	17.1	1.20
0-347	♀	91	20.4	16.6	1.23
0-858	♀	83	18.1	14.6	1.24
0-858	♀	81	15.8	13.4	1.18
0-1094	♀	77	18.1	14.9	1.21
0-1113	♀	76	19.1	16.3	1.17
0-1035	♀	73	14.7	12.6	1.17
0-338	♀	71	14.5	11.8	1.23
0-1035	♀	65	13.3	11.0	1.21
0-1067	♀	65	13.6	11.7	1.16
0-1096	♀	57	13.5	11.4	1.18
0-1114	♀	53	12.6	10.0	1.26
0-1079	♀	43	9.0	7.3	1.23

TABLE III.—Ratio of carapace-length to abdomen-breadth in two varieties of *Gonodactylus*.

Variety.	Minimum.	Mean.	Maximum.
<i>G. chiragra</i> s. s.	1.16	1.22	1.35
<i>G. chiragra</i> var. <i>platysoma</i>	1.01	1.03	1.09

The other characters of the variety are clearly defined in all the specimens in the collection. The raptorial dactylus is short and is not markedly curved at the apex; the lateral teeth of the telson margin are entirely suppressed, and if classified according to Borradaile's scheme, the specimens would belong to form G, or to a phase intermediate between it and form F.

The dorsal processes of the ophthalmic somite are considerably larger in variety *platysoma* than in typical *G. chiragra*. In the latter the external margins of the processes are parallel,* whereas in the former they are posteriorly divergent.

The pair of approximate dark spots on the first abdominal somite is distinct in all specimens of the variety and absent in all examples of *G. chiragra*, sensu stricto, while in most individuals a black patch is conspicuous on either side of the last thoracic somite and posteriorly on the fifth abdominal somite midway between the lateral margin and the middorsal line. Patches of pigment are also frequently visible in the middle of the sixth and seventh thoracic somites.

Gonodactylus demani Henderson.

Gonodactylus demani KEMP, Mem. Ind. Mus. (1913), 4, 164, 198, Pl. IX, figs. 108-111.

No. 0-1088. Taytay, Palawan, from coral (Cowles and Laki), April 21, 1913, 3 ♂, 3 ♀, 10-19 mm.

The specimens agree very closely with those which I have examined from the type locality,⁵ and like them do not possess setae on the inner margin of the uropod. The spinules on the telson are not numerous, but are much sharper than is customary; they occur only at the distal ends of the 3 median ridges and on the swollen bases of the marginal teeth.

All the specimens show the characteristic transverse rows of black spots (bright blue in life) on the carapace and abdomen.

Gonodactylus glabrous Brooks.

Gonodactylus glabrous KEMP, Mem. Ind. Mus. (1913), 4, 167.

No. 0-133. Bantayan, Cebu Province, 1909, 1 ♂, 55 mm. No. 0-342. Bantayan, Cebu Province, 1909, 3 ♂, 1 ♀, 39-63 mm. No. 0-665. C 32. Port

* See Kemp (1914), Pl. IX, fig. 107.

⁵ Loc. cit., p. 198.

Galera, Mindoro (Scale), April 15, 1912, 1 ♀, 32 mm. No. 0-1088. Taytay, Palawan (Cowles), April 21, 1913, 1 juv., 15 mm.

The majority of the above specimens belong to form B, which Borradaile names "var. rotundus." One specimen, however, is of the narrow-keeled type, form A (= var. *ternatensis* de Man), and one, in which the keels of the telson are swollen, but possess prominent terminal spines, is intermediate between the two forms.

Genodactylus proximus sp. nov. Plate I, figs. 9, 10.

No. 0-652. Port Galera, Mindoro (Cowles), 2 ♂, 3 ♀, 12-15 mm.

The carapace is longer than broad, with the posterior margin concave. The anterior margins on either side of the rostrum are straight, but slope strongly backward toward the anterolateral angles, which are subacute and slightly produced (fig. 9). The rostrum is sharply trispinous; the basal portion from which the spines arise is remarkably short, its length being less than one quarter its breadth. The 2 anterolateral spines are strongly curved and but little stouter than the central spine, which reaches at least to the middle of the eyestalks.

The dorsal processes of the ophthalmic somite are visible between the rostral spines (fig. 9). They are small and wing-shaped, with straight anterior margins and a lateral margin that slopes inward posteriorly; the anterolateral corners of the processes reach to a point midway between the median and lateral rostral spines on either side. The eyes are cylindrical and extend a trifle beyond the second segment of the antennular peduncle; the cornea in dorsal view is not wider than the stalk.

The mandibular palp appears to be wholly absent.

The dactylus of the raptorial claws resembles that of *G. nefandus* and is less strongly swollen than in *G. pulchellus*; at its proximal end it is distinctly notched externally.

The lateral margins of the exposed thoracic somites are rounded; the posterolateral angle of the third abdominal somite is rectangular, those of the fourth and fifth somites subacute. Each of the first 4 abdominal somites is grooved close to the lateral margin, and inward from this groove a small dimple or depression is visible; the median portions of the somite are in every case quite smooth. The fifth somite is feebly ridged longitudinally on either side, but in the middle is quite smooth (fig. 10), in this respect differing from the allied species, *G. tuberosus* and *G. trispinosus*. On the last abdominal somite the usual transverse row of 6 large tubercles is distinct.

The telson is almost circular in shape and bears in the anterior

half of its dorsal surface 3 small, high tubercles, which are oval in shape and widely separated from one another (fig. 10). These tubercles are not beset with setæ as in certain allied species. In the middle of the distal margin there is a narrow fissure, cut right through the telson, which extends as far as the level of the lateral dorsal tubercles. On either side of it 4 broad marginal teeth are defined by means of triangular notches in the edge. In this respect the species resembles *G. nefandus* and differs from other forms in which the teeth are separated by narrow and deep fissures similar to the central one. Each marginal tooth bears a small spinule on its inner edge, and there is a series of 7 or 8 still smaller spinules on the inner margin of each submedian tooth.

The basal process of the uropods terminates in 2 spines, the outer more than twice the length of the inner. There are 8 or 9 movable spines on the external margin of the proximal segment of the outer uropod. The inner uropod is normal in shape and bears setæ all around its margin.

This species forms one of a small group of closely allied species which are somewhat difficult to determine with any facility. The related forms are *G. trispinosus* Dana, *G. pulchellus* Miers, *G. tuberosus* Pocock, and *G. nefandus* Kemp. In the form of its rostrum *G. proximus* agrees with the first two of these species; it resembles *G. nefandus* with respect to the incisions in the margin of the telson, and *G. tuberosus* in the development of the dorsal processes of the ophthalmic somite.

The absence of the mandibular palp is unexpected. The palp is present and 2-segmented in all the closely allied forms (except *G. trispinosus*, in which it has not been examined), and from the fact that it is similarly developed in the more distantly related *G. glaber* Lenz, *G. glyptocercus* Wood-Mason, *G. excavatus* Miers, and *G. spinosissimus* Pfeffer it was natural to conclude that the character would be found constant throughout the section to which all these species belong.*

The distinctions on which I rely for the discrimination of the 5 closely allied species of the *trispinosus*-group are shown in tabular form on page 185. Of *G. trispinosus* I have seen no specimens; the details given are derived from the excellent figure and description which Borradaile has supplied.⁷ *Gonodactylus tuberosus*, another species which I have not been able to examine

* See Kemp, loc. cit., p. 146.

⁷ *Proc. Zool. Soc. London* (1898), 33, Pl. V, figs. 1, 1a. Additional notes on this species recently have been published by Miss Rathbun, *Proc. Zool. Soc. London* (1914), 663, Pl. II, figs. 11, 12.

TABLE IV.—*Distinctive characters of five closely allied species of Gonodactylus.*

	<i>G. trispinosus</i> Dana.	<i>G. pulchellus</i> Miers.	<i>G. proximus</i> sp. nov.	<i>G. tuberosus</i> Pocock.	<i>G. nefandus</i> Kemp.
Rostrum.....	Sharply trispinous; basal portion short and produced anterolaterally to sharp and slender spines.	Sharply trispinous; basal portion short and produced anterolaterally to sharp and slender spines.	Sharply trispinous; basal portion very short and produced anterolaterally to sharp and slender spines.	With basal portion long; its anterolateral angles acute, but not forming spines similar to central one.	With basal portion long; its anterolateral angles acute, but not forming spines similar to central one.
Dorsal processes of ophthalmic somite.	Strongly produced laterally (<i>vide</i> Borradaile's fig.).	Strongly produced laterally, nearly reaching lateral rostral spine.	But little produced laterally, external margin reaching midway between central and lateral spines of rostrum.	But little produced laterally, external margin reaching midway between central and lateral spines of rostrum.	Very small and inconspicuous, not produced laterally.
Anterior margin of carapace on either side of rostral base.	Almost straight with a slight backward slope; anterolateral angles not (?) subacute.	Concave; anterolateral angles subacute.	Straight with a strong backward slope; anterolateral angles slightly produced and subacute.	Straight, with a very slight backward slope; anterolateral angles rounded and slightly obtuse.	Straight, not sloping backward; anterolateral angles rectangular.
Mandibular palp	(?)	Two-segmented	Absent	Two-segmented	Two-segmented.
Median portion of fifth abdominal somite.	Longitudinally corrugated.	Quite smooth.....	Quite smooth	Irregularly rugose, with deeper, subcircular, confluent pits or punctations.	Quite smooth.
Dorsal tubercles of telson.	Not widely separated, clothed with fine setæ.	Not widely separated, clothed with fine setæ.	Widely separated, not clothed with setæ.	Not widely separated, clothed with setæ.	Partially fused proximally, not clothed with setæ.
Lateral fissures in telson margin.	Very narrow and deeply cut, extending fully halfway to lateral dorsal tubercle.	Very narrow and deeply cut, extending fully halfway to lateral dorsal tubercle.	Represented merely by triangular incisions between lateral marginal teeth.	Narrow and deeply cut, extending fully halfway to lateral dorsal tubercle.	Represented merely by triangular incisions between lateral marginal teeth.

personally, is only known from Pocock's very brief description.* For the information given in the table I am under great obligation to Doctor Calman, who at my request made a special examination of the original specimens preserved in the British Museum. From the combination of characters which it possesses it is evident that *G. tuberosus* is quite distinct from any of the allied species.

Gonodactylus glaber Lenz.

Gonodactylus glaber KEMP, Mem. Ind. Mus. (1913), 4, 182, Pl. X, fig. 121.

No. 0-338. Port Galera, Mindoro (Cowles), March 30, 1912, 2 ♀, 24 and 25 mm.

The two specimens differ considerably from the examples in the Indian Museum. The last abdominal somite and telson are fused together, and the groove separating them is wholly invisible. There is, moreover, no trace whatever of the elevations on the sixth somite, while those on the telson are only very slightly raised above the surface.

The differences are so great that I would without hesitation have referred the specimens to a new variety, or even species, had it not been that they are in extremely poor condition and that there is a possibility that the characters noted are due merely to post-mortem changes. The specimens have evidently been preserved in strong formalin, and I am inclined to think that this, while it has greatly softened all the calcareous parts, has caused the hinder end of the body to swell and thus has obliterated to a great extent the sculpture of those parts.

Gonodactylus glaber has hitherto been recorded only from the Andaman Islands, Ceylon, and Zanzibar.

Gonodactylus glyptocercus Wood-Mason.

Gonodactylus glyptocercus KEMP, Mem. Ind. Mus. (1913), 4, 186.

No. 0-338. Port Galera, Mindoro (Cowles), March 30, 1912, 1 ♀, 25 mm.

Gonodactylus spinosissimus Pfeffer.

Gonodactylus spinosissimus KEMP, Mem. Ind. Mus. (1913), 4, 191, Pl. X, figs. 124, 125.

No. 0-1088. Taytay, Palawan (Cowles and Laki), April 21, 1913, 2 ♀, 31 and 34 mm.

This species has hitherto been recorded only from the Red Sea, Ceylon, and Zanzibar.

* Ann. & Mag. Nat. Hist. (6) (1893), 11, 476, Pl. XXB, fig. 2.

ILLUSTRATIONS

PLATE I

(Drawings by A. Chowdhary.)

FIG. 1. *Pseudosquilla megalophthalma* Bigelow. Dorsal view of the Philippine specimen. $\times 1\frac{1}{2}$.

FIGS. 2 and 3. *Lysiosquilla multifasciata* Wood-Mason.

2. Dorsal view of a very young specimen, showing the characteristic pigmentation. $\times 1\frac{1}{2}$.

3. Dorsal view of an older specimen, showing a further stage in the development of the pigment-pattern. $\times 1\frac{1}{2}$.

FIGS. 4 to 8. *Lysiosquilla vicina* Nobili.

4. Dorsal view of one of the Philippine specimens. $\times 2$.

5. Rostrum. $\times 4$.

6. Last four segments of raptorial claw. $\times 3\frac{1}{2}$.

7. Last abdominal somite and telson. $\times 3\frac{1}{2}$.

8. Telson seen from below. $\times 6\frac{1}{2}$.

FIGS. 9 and 10. *Gonodactylus proximus* sp. nov.

9. Anterior part of carapace, rostrum, etc., in dorsal view. $\times 5\frac{1}{2}$.

10. Last two abdominal somites, telson, and left uropods. $\times 5\frac{1}{2}$.

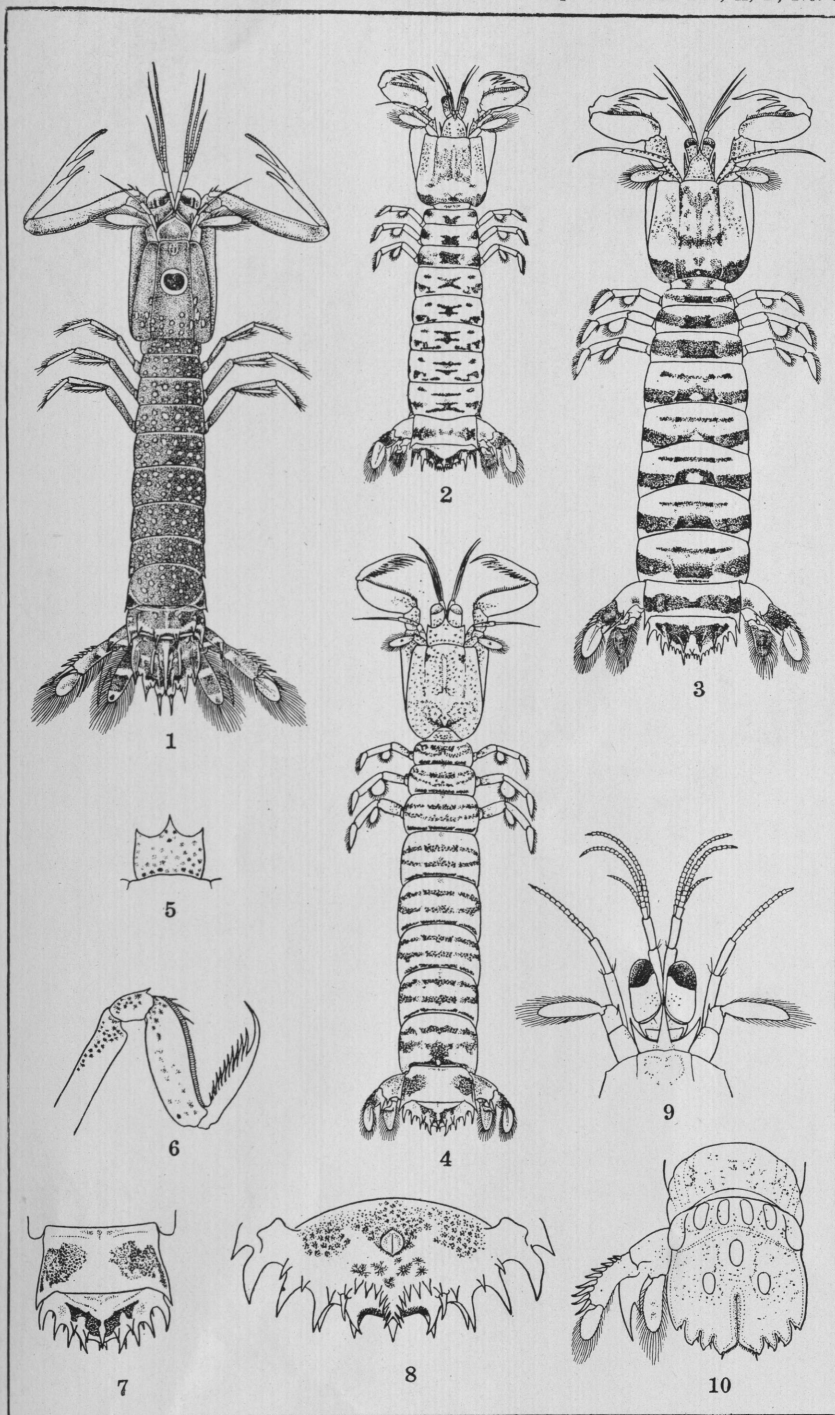


PLATE I. PHILIPPINE STOMATOPOD CRUSTACEA.

STUDIES IN PHILIPPINE JASSOIDEA: III, THE STENOCOTIDÆ OF THE PHILIPPINES

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FOUR TEXT FIGURES

The genus *Signoretia* is as unique among the Jassoidea of the Oriental Region as *Megophthalmus* and *Ulopa* are among those of the Palæarctic Region. The type of the genus, *S. malaya* Stål, from Malacca, was described in 1855, and first placed in the genus *Thamnotettix*, from which Stål removed it in 1858 to a position near *Paropia* (*Megophthalmus*). Atkinson properly followed this suggestion¹ and placed it in the "Subfamily Paropina Fieber," but most authors have appended *Signoretia* to the Tettigoniellidæ, although it is entirely outside of this family in its essential characters. In 1903 Melichar² described a new species, *Signoretia gratiosa*; Distant³ made this the type of a new genus, *Preta*, which has scarcely more than the value of a subgenus. Melichar⁴ also described from Ceylon a new genus with one species, *Pythamus dealbatus*, evidently related to *Signoretia*. Distant⁵ added two new species to *Signoretia*: *S. aureola*, from Burma, and *S. greeni*, from Ceylon. Finally, Schmidt⁶ added a new species, *S. sumatrana*, from Sumatra.

Similar difficulties have been encountered in the location of the Australian Stenocotinæ, which have usually been appended to the Ledridæ on account of the reduction in armature of the hind tibiæ, although in other characters they show slight relationship to the true Ledridæ. As a matter of fact the armature of the legs in the true ledrids is widely variable and has never been carefully studied nor figured. Single character separations have produced many very unnatural results in the taxonomy of the jassoid insects. Some ancient errors of statement regarding the armature of the posterior tibiæ in certain jassoid groups, that must

¹ Notes on Indian Rhynchota (1885), No. 2, 91.

² Homop. Ceylon (1903), 160.

³ Fauna Brit. Ind.—Rhynch. (1907), 4, 234.

⁴ Homop. Ceylon (1907).

⁵ Loc. cit.

⁶ Stett. Ent. Zeitg. (1911), 72, 298.

date from the days of low-power lenses, have been commonly repeated without reëxamination and perpetuated to the present day. Thus *Ulopa* is described as having the posterior tibiæ armed only with soft hairs, whereas under the compound microscope short stout spines are to be found, in distribution very similar to those of *Signoretia*, only smaller. Even Stål said of *Ulopa*, "tibiis posticis inermibus." In spite of the fact that Kirkaldy had dubbed *Ulopa* a membracid, it is very closely related to *Megophthalmus* and the Stenocotinæ, its former separation being very inexact and artificial. A significant indication is the possession by most of these insects of a most remarkable type of sculpturation, consisting of pits, in each of which is a small setigerous tubercle. The structure of the fore margin of the head in *Ulopa* calls to mind *Pythamus* and the Stenocotinæ, a small triangular field indicating a vestige of ocellar sulcus, although the ocelli are apparently absent. The extraordinary tuberculate pitting of the surface would make the identification of ocellar rudiments difficult. Another and unrelated genus, *Aglena*, commonly reported as without ocelli and placed in the Tettigoniellidæ, when examined under the compound microscope exhibits rudiments of ocelli on the extreme anterior margin of the head, and is a true jassid, as its general habitus would suggest. The profound impression of the facial sutures in *Ulopa* gives it a unique appearance, but its front is no more swollen than that of *Signoretia tagalica*. The armature of the hind tibiæ is scarcely different from that of *Signoretia* in anything except size, and the tibiæ are similarly sulcate. It also has the same strong ledges above the antennal scrobes, the superior frontal suture continuous below the margin of the vertex, and the veins of the tegmina basally strongly elevated. Evidently *Ulopa* represents a group very close indeed to the Stenocotidæ as recognized here. The genus *Moonia* of Distant, with some of its relatives, is likewise more closely related to these forms than to the Bythoscopidæ (excluding the eurytelids), where it has been placed.

On the other hand, *Megophthalmus*, the Stenocotinæ, *Signoretia*, *Preta*, and *Pythamus* exhibit a striking similarity in the structure of the head and in the position of the ocelli. The ocelli are set in broad or narrow, more or less profound sulci below the border of the vertex and above the margin of the front. The sculpturation of all these insects is very heavy, consisting largely of very coarse pitting or striation, which usually extends on to the more or less coriaceous tegmina. The vertex of all is more or less excavated or carinate, or occasionally both. The antennæ are seated in deep scrobes beneath a more

or less strongly projecting and usually carinate ledge. In all, the pronotum is more or less strongly rounded between the eyes, and with strong and usually complete lateral carinæ. The pronotum is either normal in form or strongly extended posteriorly and largely covering the scutellum. The venation of the tegmina varies from very simple to most complex. The armature of the hind tibiæ varies from the numerous spines and teeth of *Pythamus* to the few teeth and weak hairs of *Megophthalmus*. In a few of the forms the hind tibiæ are longitudinally sulcate. Among the true Ledridæ, however, can be found as wide variation in tibial armature as in this group. None of these forms possesses the remarkable structure of face common to the true Ledridæ. Much wider variation in structure of head and thorax and in venation of tegmina is to be found in the family Tettigoniellidæ. From all of the evidence available it seems that this group is a natural one, as worthy of distinction in the Jassoidea as are Ledridæ and Tettigoniellidæ, the whole group to be included in one family, the Stenocotidæ.⁷ It is true that *Megophthalmus* is only Palearctic, while the Stenocotinæ are Australasian, but Kirkaldy⁸ has described a genus, *Kahavalu*, from Australia, which is very closely related to *Megophthalmus*, if not congeneric with it.

Rearrangement of these groups along more natural lines, and based upon more detailed knowledge, has been delayed, because the older species, often the types of the groups, have remained but little known as to their structural details. The older figures, and some of the later ones, are extremely misleading, and the older descriptions are usually inadequate. For instance, specimens of *Megophthalmus scanicus* Fall, of Sahlberg's collecting, received from Doctor Reuter, cannot be placed in any position under the microscope that will cause the face to appear in the least like the cut in Fieber's "Les Cicadines d'Europe." Sketches from these specimens made with camera lucida are presented herewith (fig. 1). No previously published detail drawings of *Signoretia* are known to me. In fact, even the exact determination of *Signoretia malaya* Stål, the type of the genus, is open

⁷ An instance of very unnatural association is Oshanin's reference of the Persian genus *Adelungia* to the family Koebeliidæ, described by me in *Psyche* (1907), 8, 76. *Koebelia* has a ledroid habitus with thin horizontally laminate vertex, but the ocelli are on the face. *Adelungia* has a strikingly bythoscopoid habitus, but the head is provided with a porrect laterally compressed process. The two genera have not the remotest relationship. *Adelungia* pertains to the Bythoscopidæ and should there form a new subfamily, the Adelungiinæ.

⁸ *Bull. Rep. Exp. Sta. Hawaiian Sug. Pl. Assoc.* (1906), 1, pt. 9, 371.

to doubt, due to lack of full descriptions and figures. It is not at all certain that the Indian, Malaccan, and Philippine forms referred to this species will turn out to be the same, when studied in detail side by side.

Signoretia has long been recorded from the Philippines, and we can now add *Pythamus*, with a remarkably interesting species.

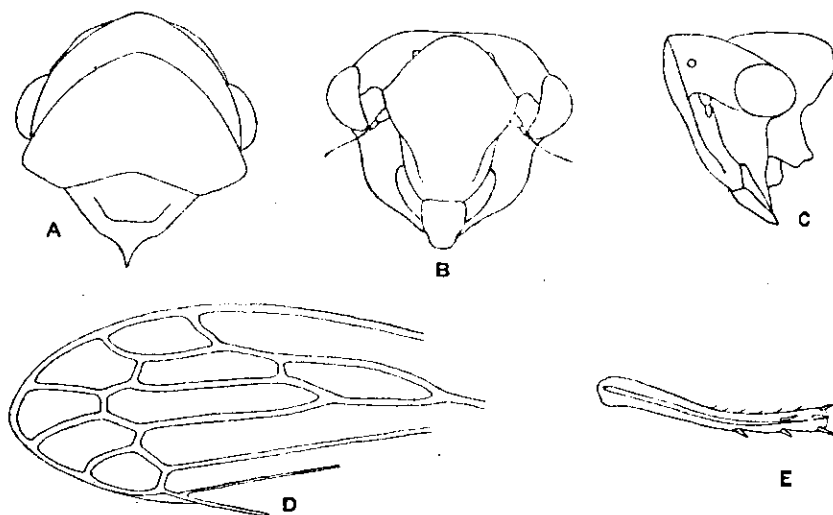


FIG. 1. *Megophthalmus scanicus* Fall. a, upper surface of head, pronotum, and scutellum; b, face; c, lateral view of head and pronotum; d, apical half of tegmina; e, posterior tibia.

STENOCOTIDÆ

Synopsis of the subfamilies.

a¹. Venation of tegmina complex, usually with numerous supernumerary veins, the apical cells irregular and numerous, and the anteapicals at least 3; pronotum reaching far cephalad of eyes, but normal posteriorly; sculpturing of vertex, pronotum, and scutellum largely a coarse striation; ocellar sulci closed toward the eyes; clavus apparently with a single median vein, although distally sometimes with supernumerary veinlets; "posterior tibiæ" quadricarinate, with six strong spiniferous spurs on the outer margin, shortly but strongly spined on the upper margin, and feebly bristled on the others" (Kirkaldy).

Stenocotinae.

a¹. Venation of tegmina simple, without supernumerary veins, the apical cells 4; sculpturing of vertex, pronotum, and scutellum largely a very coarse puncturation; ocellar sulcus open to eyes.

b¹. Ocelli nearer to median line than to eyes; pronotum extending cephalad of eyes; tegmina with 2 anteapical and 1 basal cell; clavus with 2 longitudinal veins; posterior tibiæ sulcate and with few spines and short hairs..... *Megophthalmina*.

- b*². Ocelli nearer to eyes than to median line; pronotum not extending cephalad of eyes; tegmina with 1 anteapical cell or none.
- c*¹. Pronotum greatly extended caudad, largely covering the scutellum, and strongly convex; head as wide as, or wider than, pronotum; genæ very short; clavus with 2 longitudinal veins, occasionally connate; posterior tibiae with comparatively few spines and short hairs *Signoretiniæ*.
- c*¹. Pronotum normal, shallowly incurved posteriorly, the exposed scutellum large; head distinctly narrower than pronotum, the pronotum not projecting between the eyes to half their length; clavus apparently with a single longitudinal vein; posterior tibiae with several thick-set rows of spines *Pythamiinæ*.

STENOCOTINÆ

Synopsis of the genera (after Kirkaldy).

- a*¹. Scutellum plane.
- b*¹. Vertex plane *Stenocotis* Stål.
- b*². Vertex somewhat recurved *Smicrocotis* Kirk.
- a*². Scutellum cristate *Kyphocotis* Kirk.

MEGOPHTHALMINÆ

Synopsis of the genera.

- a*¹. Ocellar sulcus broad.
- b*¹. Clypeus short, scarcely longer than broad, sides rounded; ocelli above the eyes in facial view *Megophthalmus* Curt.
- b*². Clypeus three times as long as broad, the sides subparallel; ocelli between the eyes in facial view *Paropulopa* Fieb.
- a*². Ocellar sulcus narrow *Kahavalu* Kirk.

SIGNORETIINÆ

Synopsis of the genera.

- a*¹. Pronotum anteriorly with 2 very short, submedian carinæ; vertex blunt, usually broadly irregularly rounded between the eyes; clavus with 2 complete and distinct longitudinal veins *Signoretia* Stål.
- a*². Pronotum with 2 complete submedian carinæ; vertex long and rather acutely pointed; clavus with the 2 veins apparently medially connate. *Preta* Dist.

PYTHAMIINÆ

Synopsis of the genera.

- a*¹. Vertex with a high, laminate, median carina; tegmina with very distinct venation, basally with setigerous tuberculate pits similar to those on pronotum *Pythamus* Mel.
- a*². Vertex raised toward median line, but not carinate; tegmina subcoriaceous, venation very indistinct *Tortor* Kirk.*

* This genus is placed here provisionally.

PHILIPPINE REPRESENTATIVES OF THE STENOCOTIDÆ

SIGNORETIINÆ

Genus SIGNORETIA Stål

Signoretia malaya Stål.

Stål, Of. Vet. Ak. Forh. (1855), 192 (*Thamnotettix*).

Stål, Freg. Eug. Resa (1858), 290.

Atkinson, Journ. As. Soc. Bengal (1885), 54, 91.

Distant, Fauna Brit. India—Rhynch. (1907), 4, 232.

Head, most of pronotum and abdomen, except genitalia, stramineous; the following parts virescent: posterior portion of pronotum, clavus at base and extreme apex, 2 inner sectors of corium apically, clypeus, forelegs, middle and hind tibiæ except base, all tarsi, and the genitalia. Tegmina albescent, the veins in apical area fuscous. Length ♀, 7 mm.

Length of face greater than width across eyes (fig. 2, b). Front and clypeus strongly ridged, on former the ridge sharply carinate, surface adjoining ridge depressed, broadly so on upper part of front. Lateral faces of front convex and with about 9 weak, incomplete ridges; surface otherwise only irregularly and very minutely roughened. Facial ridge terminating in central swollen portion of clypeus; apical angles of clypeus depressed and laminate, length of clypeus about half that of front. Temples with a lobular extension of ledge above scrobe extending over the lateral margin of front (hidden in facial view). Ocellar sulcus very narrow at apex of head and continuous except for a minute, blackish median carina, laterally twice suddenly broadened, the ocellus less than its own width from the eyes. Length of vertex more than half its width between the eyes, its plane parallel with the long axis of the body; the profound discal concavity of the vertex medially carinate, the carina brownish anteriorly, the surface of the area minutely tuberculate; the thick basal transverse ridge nearly straight, and with a brownish dot at center, the thin extremities of this ridge obliquely continued to behind eyes.

Pronotum (fig. 2, a) about three times the length of vertex; the lateral margin about two and one half times into the width; the marginal carina strong, straight, and complete; pleuræ deeply furrowed and with a short transverse carina at two thirds of the depth. Sculpturing of the pronotum and pleuræ a very coarse and continuous bordered thimble-pitting, at the bottom of each pit a minute setigerous tubercle, exactly the peculiar character of sculpturing found in *Ulopa*, *Megophthalmus*, and *Pythamus*; a strong narrow depression from one lateral angle to the other,

passing one seventh of the length from the anterior border, and following the curve of the anterior margin; submedially this submarginal depression is crossed by 2 short longitudinal carinae. Exposed portion of scutellum less than one fourth the length of pronotum, and with a curved transverse ridge at center. Veins of tegmina carinately prominent and strongly pit-bordered back of apical cells; basal half of clavus, and basal two thirds of 2

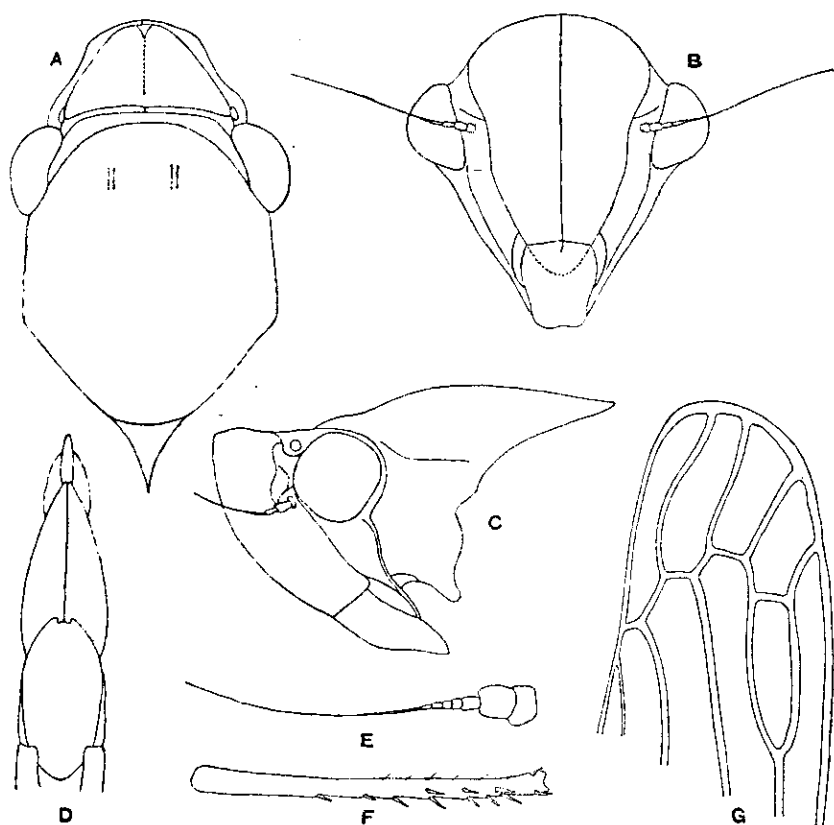


FIG. 2. *Signoretia malaya* Stål. a, upper surface of head, pronotum, and scutellum; b, face; c, side view of head and pronotum; d, female genitalia (abnormally extruded); e, antenna; f, posterior tibia; g, apical half of tegmina.

outer areas of corium, thickly thimble-pitted like the pronotum; tegmina entirely without an appendix, but the marginal vein apically very thick; margin of basal cell of clavus three times as long on the commissure as on the anal margin. Genitalia in this specimen unnaturally extruded (fig. 2), but subgenital plate of great length, subelliptical, strongly medially ridged and carinate, and the apex narrowly shallowly sinuate-emarginate. Posterior tibiae prismatic, shallowly sulcate on one side, the outer borders

spined as shown in fig. 2, *b*, but the inner angle, not shown in figure, with a thick-set row of slender spines.

Apparently rare at Los Baños, Luzon.

As that species has been described, it is only possible to refer our form provisionally to *S. malaya* of Stål, at this time. As stated, there is great need for the more thorough study of the type.

Signoretia tagalica sp. nov.

Stramineous, vertex with 2 transverse submedian brown dots near anterior border and a brown dot above each ocellus; tegmina albescent, with the veins in apical area fuscous. Length, ♂ 6.5, ♀ 7 mm.

Length of face less than width across eyes (fig. 3, *b*). Front more strongly inflated than in *S. malaya* and smoother, the median carina not extending on to the clypeus. The swollen margin of genæ very broad below, reaching the genæ. Clypeus much more than half the length of the front. Face otherwise, with temples, similar to that of *malaya*. The narrow connection of ocellar sulci in *malaya* is here shallower and less sharply marked; laterally the ocellar area is twice broadened as in *malaya*, but the two subareas are separated by a longitudinal ridge, that in which the ocellus is situated being the deeper; ocellus distant much more than its width from the eye. Length of vertex less than half of its width between the eyes, its plane strongly declivous to the long axis of the body; the distal concavity less profound than in *malaya* and entirely without a median carina, the inner surface finely tuberculate; basal transverse ridge medially distinctly angled, laterally extended to behind eyes.

Pronotum (fig. 3, *a*) more than four times the length of the vertex; the lateral margins contained more than four times in the width; the lateral carinæ less sharp than in *malaya*; pitting shallow, the margins of the pits broad, blunt, and shining, leaving a median, continuous, smooth line which becomes a carina where it crosses the anterior submarginal depression, the submedian carinæ of *malaya* at this point being entirely absent; pleuræ medially irregularly ridged instead of furrowed and without a carina on lower portion. Exposed part of scutellum about one seventh the length of pronotum, surface nearly smooth, centrally slightly umbonate. Tegmina with pitting distributed somewhat as in *malaya*, but far weaker and more irregular, and mostly lacking the setigerous tubercles. Anteapical cell far shorter than in *malaya*. Margin of basal cell of clavus little longer on the commissure than on the anal margin. Subgenital

plate not as long as in *malaya*; broadened apically where the margin projects and is broadly bisinuate. Gonapophyses of male with but few very weak hairs. Posterior tarsi very similar to those of *malaya*.

Described from a male taken on Mount Maquiling, Laguna Province, Luzon, and a female taken on the neighboring mountain mass of Banahao (types in coll. *Baker*).

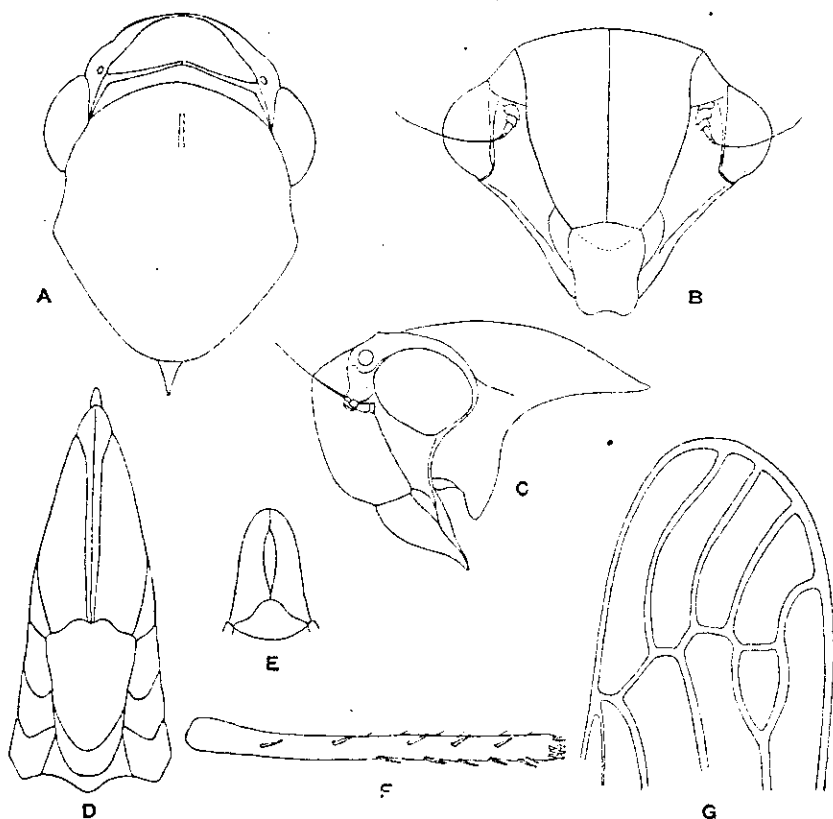


FIG. 3. *Signoretia tayalica* sp. nov. a, upper surface of head, pronotum, scutellum; b, face; c, side view of head and pronotum; d, female genitalia; e, male genitalia; f, posterior tibia; g, apical portion of tegmina.

A provisional separation of the above two species from other species of *Signoretia* may be made as follows:

a'. Vertex much longer at middle than at the sides, the length equal to, or more than, one half the width between the eyes.

b'. Head, pronotum, scutellum, and abdomen not black.

c'. Pronotum with 2 very short submedian carinae on anterior area; lateral margins of the pronotum into the width 2.5 times; body stramineous, above partly and legs virescent; length, 7 mm.

malaya Stål.

- c². Pronotum medially completely unicarinate; lateral margins of pronotum into its width about three times; body above variously colored with chocolate brown, pale ochraceous, grayish brown, and grayish; length, 7 mm. *greeni* Dist.
- b². Head, pronotum, scutellum, and abdomen black; tegmina dark, smoky brown; length, 7 mm. (Schmidt does not figure his species and does not described the structural details of head, pronotum, and tegmina, merely saying that in these particulars it is like *malaya*).
..... *sumatrana* Schmidt.
- a¹. Vertex but little longer at middle than at sides, the length less than half the width between the eyes.
- b¹. Lateral margins of pronotum into its width little more than two times; stramineous, the tegmina golden yellow, apically and basally grayish white; length, 9 mm. *aureola* Dist.
- b². Lateral margins of pronotum into its width more than four times; stramineous, the tegmina albescent; length, 7 mm. *tagalica* sp. nov.

PYTHAMIINAE

Genus PYTHAMUS Melichar

Pythamus melichari sp. nov.

Head yellowish, vertex with a very broad, irregular, transverse black band, a black spot at tip and one at each basal angle. Pronotum shining bronzy black, bluish pruinose laterally, the lateral margin yellowish, this margin shortly angularly extending inwardly at 3 points, once at the posterior lateral angle, once in the middle, and again behind the eyes. The pleura is almost entirely yellowish. Front at upper angles and on either side at antennal scrobes black-dotted. Scutellum black, shining, the lateral margins of posterior area yellowish. Tegmina black on inner half, which is bluish pruinose at base, yellowish on outer half, the veins all blackish and paler distally, distal half of apical area fuliginous. Dorsum black with yellowish lateral margins. All below yellow except apices of pygofers, which are black. In the male the yellows are more intense. Length, ♂ 5.5, ♀ 6.5 mm.

Length of face across eyes nearly once and one half the width (fig. 4, e). Front and clypeus shagreened; front not elevated medially, but sharply carinate, the carina not extending on to the clypeus; lateral surfaces of front with subobsolete transverse ridges, the lower half with indistinct submarginal brownish lines at sides. Loræ and genæ obscurely longitudinally rugose, the latter without swollen outer margin. Clypeus somewhat more than the length of front, strongly narrowed apically, the anterior angles not thin and laminate. Ocellar sulci very large and broad triangular, the inner points meeting but separated by a carina, the lower angles extending nearly to antennal scrobes, from whence a curved carina projects from the broken frontal

margin into the disk of this area; the disk of the ocellar area is shallow and coarsely transversely rugose; the ocellus is situated near its upper margin and about halfway between eye and median line of head. The anterior marginal carina of vertex curves to behind the eyes as in *Signoretia*. Length of vertex greater than width between eyes; the median carina is laminaately raised to high above the disk, its highest part being on the

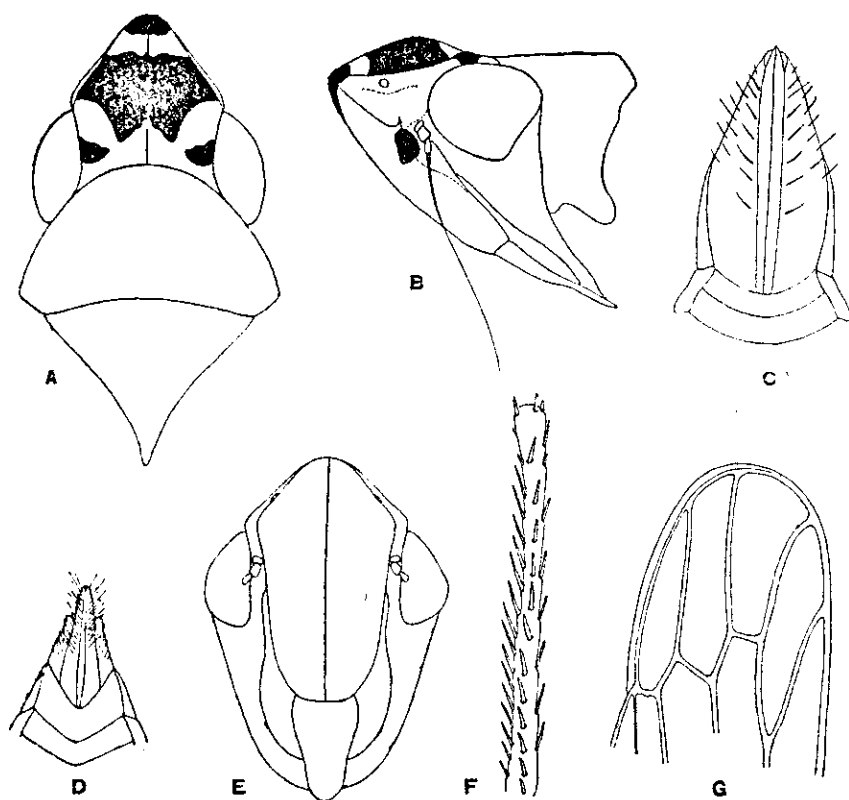


FIG. 4. *Pythamus melichari* sp. nov. a, upper surface of head, pronotum, and scutellum; b, side view of head and pronotum; c, female genitalia; d, male genitalia; e, face; f, posterior tibia; g, apical portion of tegmina.

posterior half instead of on the anterior half as figured for *Pythamus dealbatus* Mel.; the disk concave, except on posterior half near the median carina, where it is swollen against the carina, the remaining portion being finely and irregularly wrinkle concentrically to this swollen portion; the position of the basal ridge of *Signoretia* is occupied by a low transverse ridge near the posterior margin.

Pronotum (fig. 4, a) broader than head, shorter than vertex,

the posterior margin broadly evenly incurved, fully exposing the large scutellum, the lateral carinæ complete and strongly curved. The pronotum and scutellum, and the tegmina partly, have the same type of large pits as in *Signoretia*, each pit having a setigerous tubercle within, although in this case the pits are more distant and without sharp rims, the surface between them being smooth and shining, but without leaving a smooth median line on the pronotum; disk of pronotum slightly ridged along the median line, anterior area at sides only with narrowed depressions behind the eyes, these depressions occupied by yellow extensions from the lateral margins. The scutellum longer than wide and longer than the pronotum, posteriorly with a strongly impressed transverse line. Tegmina with veins less prominent than in *Signoretia*, all pit-margined, distally more weakly so; basal half of clavus and corium within at base sparingly pitted. In all the present material the fourth apical cell is confluent with the single anteapical cell. The subgenital plate (fig. 4, c) of the female is transverse, truncate posteriorly, and about twice the length of preceding (strongly bent downward in the figure). The subgenital plate of male is of similar form, the gonapophyses are long, narrow, and heavily spined, the lateral plates without curved tips and weakly haired. The hind tibiæ are prismatic and heavily spined as shown in fig. 4, f, although still another row of spines exists on the opposite side.

This species is described from several specimens taken at Puerto Princesa, Palawan Island, P. I., and is named for Dr. L. Melichar, author of many monumental works on the Homoptera. (Types in coll. Baker.)

Pythamus melichari var. *mindanaensis* var. nov.

A single male specimen from Iligan, Mindanao, is very similar to the type of *P. melichari* in general form and coloration, but differs in several secondary details. The loræ are entirely black, whereas in the type the inner margin only is faintly brown. The propleuræ are entirely black, and the yellow on the pronotal margins is greatly reduced and without inward extensions. The yellow of the tegmina is also reduced, and a greater portion of the apical area is fuliginous. The genitalia also appear to differ slightly, the gonapophyses being longer and the side plates with tips appressed. On superficial examination this specimen would not be distinguished from the species.

ILLUSTRATIONS

TEXT FIGURES

FIG. 1. *Megophthalmus scanicus* Fall.

a, upper surface of head, pronotum, and scutellum; *b*, face; *c*, lateral view of head and pronotum; *d*, apical half of tegmina; *e*, posterior tibia.

2. *Signoretia malaya* Stål.

a, upper surface of head, pronotum, and scutellum; *b*, face; *c*, side view of head and pronotum; *d*, female genitalia (abnormally extruded); *e*, antenna; *f*, posterior tibia; *g*, apical half of tegmina.

3. *Signoretia tagalica* sp. nov.

a, upper surface of head, pronotum, and scutellum; *b*, face; *c*, side view of head and pronotum; *d*, female genitalia; *e*, male genitalia; *f*, posterior tibia; *g*, apical portion of tegmina.

4. *Pythamus melichari* sp. nov.

a, upper surface of head, pronotum, and scutellum; *b*, side view of head and pronotum; *c*, female genitalia; *d*, male genitalia; *e*, face; *f*, posterior tibia; *g*, apical portion of tegmina.

NOTES ON PHILIPPINE ALCYONARIA

PART V: CORNULARIA MINUTA, A NEW SPECIES

By S. F. LIGHT

(From the Zoölogical Laboratory, College of Liberal Arts,
University of the Philippines)

SEVEN TEXT FIGURES

Cornularia minuta sp. nov. Figs. 1-7.

Specific characters.—The very minute colonies are attached to the surface of support by the creeping, anastomosing, threadlike stolons. The polyps arise from the stolons at irregular intervals, and when fully expanded have a maximum length of about 2.5 millimeters, including the tentacles, and a minimum diameter of from 0.3 to 0.4 millimeter just below the tentacles. Each polyp is connected with one or more stolons, each of which contains two or more endodermal canals lying in a thick homogeneous mesogloea. These stolons are covered with a very thin, wrinkled, perisarclike, horny envelope, an extension of which forms a cuplike covering for the basal portion of the polyps. The expanded polyps are slender, and the tentacles are about one third as long as the body of the polyp and bear on either side a single row of from 6 to 10 rather short, thick, cylindrical pinnules. When contracted, the distal portion of the polyp is retracted within the basal, horny covering, which is then cone-shaped or beehivelike. There are no spicules.

Color.—The polyps are dirty white to light yellow and more or less transparent. The perisarc of the basal portion of the polyps is dirty yellow or light brown and has a granular or corrugated appearance due to the wrinkles in its surface and to the particles of foreign matter attached to it. The stolons are white to light yellow and somewhat transparent.

Type.—No. C. 2457, zoölogical collection of the University of the Philippines; Legaspi Bay, Albay Province, Luzon, P. I.; January.

The specimens were found growing on colonies of *Siphonogorgia variabilis* Hickson from the cable in Legaspi Bay in 90 meters of water.

Systematic position.—It has been no easy matter to determine the systematic position of this alcyonarian. Its characters show

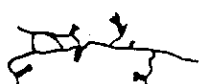


FIG. 1. Part of a colony of *Cornularia minuta* sp. nov. Actual size.

a relationship to both *Cornularia* and *Clavularia*. Its external characters are those of *Cornularia*; that is, there are no spicules, the stolons and the proximal portions of the polyp are covered with a horny envelope within which the distal portion of the polyp is retractile, and the polyps are connected by very slender cylindrical stolons. Here the similarity ceases, and the other characters are those of *Clavularia*. The stolons contain a number of endodermal canals instead of one as in *Cornularia*. These are surrounded by a very thick mesoglœa instead of the thin lamella of *Cornularia*; the polyps have a general form more like *Clavularia* than *Cornularia*, as they taper from the base to the distal end, while in *Cornularia* the basal portion of the polyp has the least diameter; the polyp in retraction has the form characteristic of *Clavularia*—that is, the distal portion is retracted within the proximal portion; and finally the perisarc, while distinct and always present, is extremely thin and might be considered as either disappearing or as being a recently acquired character. The external characters, however, are exactly those on which the generic definition of *Cornularia* is based, and we are confronted with the necessity of founding a new genus intermediate between *Cornularia* and *Clavularia* to receive the new species, or of placing it in the genus *Clavularia* in spite of the fact that in external characters it agrees with the definition of *Cornularia*, or of placing it in *Cornularia* in spite of the fact that it agrees with *Clavularia* in certain of its characters. Now that the family Cornularidæ, after much confusion and wasted effort, has been reduced to a few well-defined genera, it seems unwise to introduce new genera unless absolutely necessary. The genus *Cornularia* as now constituted contains only one or perhaps two species, and the addition of this new species should not lead to confusion even though it is atypical in some of its characters. Of course, it is out of the question to add to the already large genus *Clavularia* a form which differs so distinctly from all the known species of that genus. For these reasons I have decided to consider the species under discussion as an atypical species of the genus *Cornularia*, forming a connecting link between it and the genus *Clavularia*.

As I have stated above, the genus *Cornularia* has contained until the present time but one well-

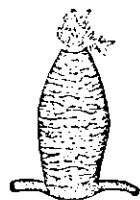


FIG. 2. A partially retracted polyp of *Cornularia minuta*, showing the wrinkled perisarclike covering of the basal portion. Much enlarged.

known species, *C. cornucopiæ* (Pallas) Schweigger, first described by Pallas (1766) as *Tubularia cornucopiæ*. This form is common in the Mediterranean and has been carefully described and figured by Cavolini (1785) and von Koch (1890). Busk (1867) named a new species, from Australia, *Cornularia australis*, basing the separation of the species on the smoothness of the horny covering of the polyps and on the difference in color. These seem to be rather slight grounds for establishing a new species, but we have the statement of so excellent an observer as Allman (Busk 1867), who was familiar with *Cornularia cornucopiæ* of the Mediterranean, that *C. australis* is specifically distinct, and the fact that the habitats of the species are widely separated is further justification for retaining Busk's species. The identity of the species of *Cornularia* named by Kent (1893), of which he gives figures but only very general descriptions, must remain in doubt. Before even their generic position can be definitely stated, we must know whether or not they have spicules, whether or not there is an outer horny envelope, and whether or not the polyps are retractile, and if retractile whether they are entirely retractile or whether they have a distal moiety retractile within a proximal moiety. None of these facts are given by Kent. His *C. parva* and *C. glauca* appear to be species of the genus *Anthelia* of the same general form as Dana's *Rhizoxenia primula*, supposing that form to have had connecting stolons. His *C. tubiporoides* has all the appearance of a species of *Clavularia*, somewhat similar, except in the length of the tentacles, to *Clavularia violacea* Quoy and Gaimard (1834). His *C. auricula* is very difficult to place. If it has, as Kent (1893) says, smooth tentacles without any pinnules whatsoever, it may belong to a new group of Alcyonaria as yet unnamed.¹ *Cornularia crassa* Milne-Edwards, according to Sars (1857) and Müller (1910), is the same as *Evagora rosea* Philippi (1842) = *Rhizoxenia rosea* Dana (1846). The species of *Cornularia* described by Quoy and Gaimard belong to other genera.

Whatever the systematic position of these doubtful forms may be, they show no resemblance to *Cornularia minuta*. The minute size, the very thin, perisarc-like, horny envelope, the presence in the stolons of a thick homogeneous mesogloea pierced by several endodermal canals, and the broadly cone-shaped form of its contracted polyps mark *Cornularia minuta* as a very distinctly new species.

¹ I have been unable to find any pinnules in *Clavularia violacea* Quoy and Gaimard.

Because of its interesting systematic position *Cornularia minuta* is worthy of careful anatomical study. However, my material is so limited in amount and so poorly preserved that I have found it impossible to make a thorough or detailed investigation of the anatomy. The few observations recorded here were made on specimens preserved in formalin.

The extremely thin, horny envelope contrasts strongly with that figured and described by von Koch (1890) and Cavolini (1785) for *C. cornucopiæ*; it averages 0.0008 millimeter in thickness on the stolons and 0.001 millimeter in thickness on the base of the polyps. It is wrinkled throughout, and although closely applied to the ectoderm in some regions, it is as a rule separated

from it by a considerable space (fig. 3 a). On the stolons the envelope appears smooth and transparent in surface view, but sections show that it is wrinkled. On the basal portion of the polyp the envelope is rather opaque and in surface view has a rough, corrugated appearance (fig. 2), which sections show to be due to wrinkling and to the presence of foreign particles rather than to inequalities in thickness.

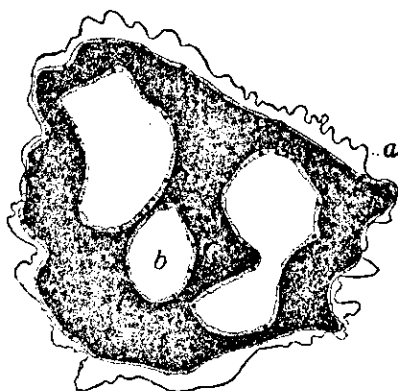


FIG. 3. A cross section of one of the stolons of *Cornularia minuta*, showing the perisarc (a), the endodermal canals (b), and the thick mesogloea. From camera lucida outlines. $\times 202.5$.

As von Koch says (1890), in speaking of *C. cornucopiæ*, this skeleton is a product of the ectoderm, similar in origin, ap-

pearance, and function to the perisarc of hydroids and of *Scyphistoma*. In *C. minuta* it has a remarkable resemblance, particularly in sections, to the perisarc of certain hydroids; indeed there seems to be no valid objection to the application of the term perisarc to the horny outer covering of the species of *Cornularia*, and I have so used the term in this article.

The thin cup of perisarc within which the polyp retracts is very flexible, as may be seen by a comparison of its shape in the expanded polyp, where its distal and proximal widths are approximately equal (fig. 4), and in contracted polyps where it is nearly closed distally and considerably broadened basally (fig. 2). This is in striking contrast to the condition in *C. cornucopiæ*, where it is thick and stiff, especially at the distal edge of the cup.

Cornularia minuta is smaller in every way than *C. cornucopiæ*; the polyps of the latter are 10 millimeters or more in length, while those of *C. minuta* when fully expanded are but from 2 to 2.5 millimeters in length from the base to the tip of the extended tentacles. These polyps are fully mature, as they were found in several cases to contain well-developed eggs. When expanded they are slender and taper slightly from the base to a region immediately below the tentacles. The tentacles are one third as long as the body of the polyp and form a crown, wide in proportion to the diameter of the polyp. This is in contrast to the condition in *C. cornucopiæ* and gives an appearance

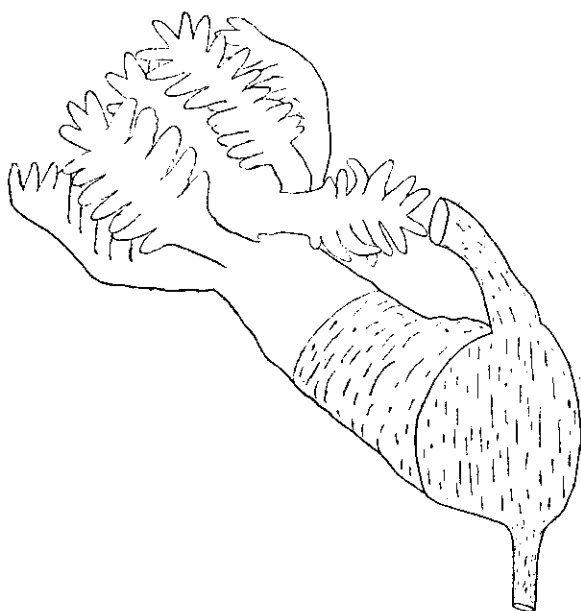


FIG. 4. Camera lucida outline of an expanded polyp of *Cornularia minuta*. $\times 23.5$.

similar to that of the polyps of certain species of *Anthelia*. The pinnules are short, thick, cylindrical, and crowded on the tentacles, and show a superficial segmentation suggestive of hydroid tentacles. They differ decidedly from those of *C. cornucopiæ* as figured by Cavolini (1785), which are long, slender, and rather widely separated on the tentacles, suggesting the arrangement in *Stereosoma* (*Anthelia*) *celebensis* Hickson (1895). This difference may be due to some extent to the contraction of the pinnules and tentacles of *C. minuta*. The oral surface shows a raised zone around a large mouth similar to that figured by Cavolini (1785) for *C. cornucopiæ*.

In contraction the entire polyp lies within the cup of perisarc

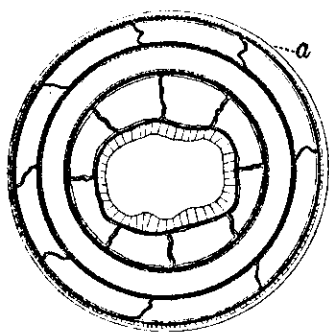


FIG. 5. A schematic representation of a transverse section through a retracted polyp of *Cornularia minuta* to show the relative positions of the body layers. a, the perisarc. The ectoderm is cross-lined, the mesogloea is in black, and the endoderm is represented by a line. (Siphonoglyphe not indicated.)

over the oral surface and are not invaginated as figured by von Koch (1890) for *Rhizoxenia (Evagora) rosea* and by Quoy and Gaimard (1834) for *Clavularia violacea*.² The stomodaeum in contracted polyps ends near the floor of the body cavity, and the mesenteries and mesenterial filaments are crowded together in its lower portion.

The ectoderm of the body wall and of the stolons is thin and rather irregular, often consisting of a single layer of flat cells so thin that the nuclei form protuberances in the layer. On the tentacles it is thicker, being a number of cells in depth, and it contains in many places large numbers of very curious oval bodies (fig. 7) consisting of an outer rounded or oval capsule containing

surrounding its base. This is from one third to one half as long as the body of the extended polyp, and in contraction has the shape of a truncated cone or an old-fashioned beehive, the distal aperture being nearly closed and the base considerably broadened. The retraction of the polyps is accomplished as in *Clavularia*, by the pushing in of the distal portion, so that a transverse section of such a polyp taken so as to cut through the stomodaeum near the mouth would cut the body wall three times as indicated in fig. 5. In retracted polyps the strongly muscled tentacles are tightly contracted and form an irregularly arranged mass

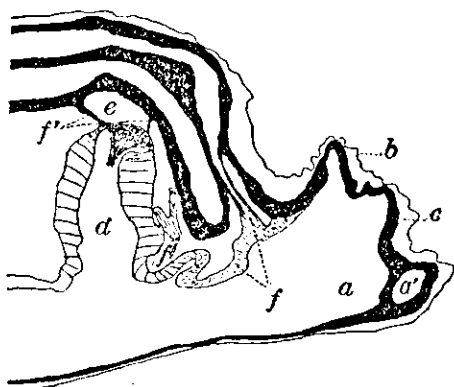


FIG. 6. A drawing, from camera lucida outlines, of part of an oblique, transverse section through a contracted polyp of *Cornularia minuta*. a, the point of junction of the body cavity and one of the stolons; a', an oblique section through one of the endodermal canals of the stolon; b, the perisarc; c, the wall of the polyp, represented in black; d, the stomodaeum; e, the siphonoglyphe; f and f', mesenteries. $\times 65.5$.

²I fail to find this invagination in Philippine specimens of *Clavularia violacea*. Notes on Philippine Alcyonaria, Pt. IV. *This Journal*, Sec. A (1915), 10, 155.

a spherical nonstaining body and a half-moon-shaped, darkly staining body—apparently a nucleus. The fact that these bodies are found in the ectoderm and that these Alcyonaria came from a depth of 90 meters makes it improbable that we have here a form of unicellular algæ related to those so common in the endoderm of all shallow-water Philippine Alcyonaria. The clear spherical area, however, is strikingly like that surrounding the chromatophore in *Zoöxanthellæ*, but there is no central staining area as in these algæ. A test for starch would very likely show whether these are algæ or not, but unfortunately I have no material to spare for such a test. They may be differentiated ectoderm cells containing nematocysts of some peculiar type, the dark-staining body being the nucleus of the ectoderm cell. The nuclei of the typical ectoderm cells are quite distinct (fig. 7), however, and the clear spherule shows none of the structure characteristic of nematocysts. Again they may be some protozoan parasite or symbiote, the clear area being a vacuole. Here and there in the ectoderm of the tentacles are enlarged cells completely filled with small, deeply staining, rounded bodies which may be another stage in the life cycle of such a parasite. Because of lack of material the determination of the exact nature of these very curious and interesting little bodies must be left to some future investigator.

As would be expected in so contractile a form as *C. minuta*, the musculature is heavy. The ectoderm of the tentacles is penetrated by numerous "muscle banners," which are very conspicuous in sections of the contracted polyp. The thick ectoderm of the oral surface also overlies a layer of muscle fibers.

The mesogloea, which is everywhere a homogeneous mass showing no penetrating rods of cells as in *Xenia* and other genera, nor scattered amoeboid cells as in *Capnella*, *Lemnalia*, *Lithophytum*, etc., is outlined by an outer and inner deeply staining line. In the body wall the mesogloæal layer averages 0.004 millimeter in thickness, which is about the average thickness of the ectoderm and of the endoderm of the same region. On the oral surface and in the tentacles it is much thickened and sends out

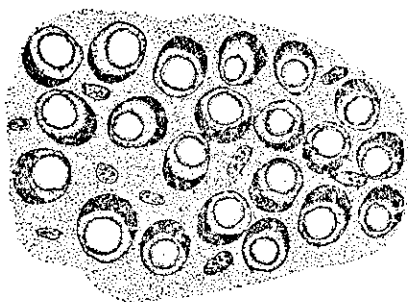


FIG. 7. An oblique section through the ectoderm of a tentacle of *Cornularia minuta*, showing the ectoderm nuclei and the peculiar bodies found in the ectoderm cells. $\times 13,40$.

great numbers of supporting lamellæ for muscle attachment. In the tentacles of contracted specimens its edges are complexly folded.

The stomodæum, which is about one third as long as the body of the extended polyp, is lined with the characteristic ciliated columnar epithelium. Scattered among these cells are numbers of goblet-shaped gland cells, making it probable that the stomodæum has in *C. minuta*, as in *Xenia* (Ashworth, 1899), a digestive function. The siphonoglyphe is distinct and separated from the rest of the stomodæum by two deep grooves. It extends with little change from the mouth to the proximal end of the stomodæum. The prominence of the siphonoglyphe in so small a form is not in accord with Hickson's theory (1883) as to the proportion between the development of the siphonoglyphe and the extent of the cavity supplied by a single polyp. The cells of the siphonoglyphe are long and very narrow with deeply staining elongated nuclei and basal portions and lightly staining outer areas. The cilia reach a length of 0.04 millimeter.

The endoderm of the body like the ectoderm consists of a thin layer, usually one cell thick, of flat broad cells. In the tentacles the layer is thicker, and the cells are of the myoepithelial type (Hickson, 1895).

The mesenteries have the structure typical for most Alcyonaria. The retractor muscles are strongly developed as would be expected in so contractile a form. The ventral mesenterial filaments lack the central groove, but are otherwise typical and have cells which resemble very closely those of the siphonoglyphe.

The stolons average about 0.25 millimeter in diameter and lie within the thin, wrinkled, loosely attached envelope of perisarc. They consist of a thick, homogeneous mesogloea covered by a thin, irregular layer of ectoderm, usually one cell deep. This mesogloea is pierced by from two to four endodermal canals lined with a smooth layer of thin, flat endoderm, one cell deep (fig. 3). As I have noted before, this type of structure agrees with that found in the stolons of those species of *Clavularia* having fili-form stolons and is quite different from that of *Cornularia cornucopiæ*.

A number of eggs which seem to be fairly mature were found in the sections. They were attached to the mesenteries near the bottom of the body cavity and are as usual covered with a layer of mesogloea and endoderm. The eggs measure 0.04 millimeter in length, and 0.03 millimeter in breadth. The nucleus is large, averaging 0.022 millimeter in length and 0.016 millimeter in breadth. It contains a number of deeply staining

structureless spheres. The cytoplasm is finely reticulated. This specimen was collected early in January, and hence its breeding season, if definite, is probably during January and February.

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ILLUSTRATIONS

TEXT FIGURES

- FIG. 1. Part of a colony of *Cornularia minuta* sp. nov. Actual size.
2. A partially retracted polyp of *Cornularia minuta*, showing the wrinkled perisarclike covering of the basal portion. Much enlarged.
 3. A cross section of one of the stolons of *Cornularia minuta*, showing the perisarc (*a*), the endodermal canals (*b*), and the thick mesogloea. From camera lucida outlines. $\times 202.5$.
 4. Camera lucida outline of an expanded polyp of *Cornularia minuta*. $\times 23.5$.
 5. A schematic representation of a transverse section through a retracted polyp of *Cornularia minuta* to show the relative positions of the body layers. *a*, the perisarc. The ectoderm is cross-lined, the mesogloea is in black, and the endoderm is represented by a line. (Siphonoglyphe not indicated.)
 6. A drawing, from camera lucida outlines, of part of an oblique, transverse section through a contracted polyp of *Cornularia minuta*. *a*, the point of junction of the body cavity and one of the stolons; *a'*, an oblique section through one of the endodermal canals of the stolon; *b*, the perisarc; *c*, the wall of the polyp, represented in black; *d*, the stomodæum; *e*, the siphonoglyphe; *f* and *f'*, mesenteries. $\times 65.5$.
 7. An oblique section through the ectoderm of a tentacle of *Cornularia minuta*, showing the ectoderm nuclei and the peculiar bodies found in the ectoderm cells. $\times 13.40$.

NOTE REGARDING THE DUGONG IN THE PHILIPPINE ISLANDS

By ALVIN SEALE

(From the Section of Ichthyology, Biological Laboratory, Bureau of Science,
Manila, P. I.)

ONE PLATE

On August 8, 1913, Capt. Edward R. Nicholson, of the Philippine Constabulary, brought to the Bureau of Science a pair of large tusks and some photographs of the Philippine dugong, *Dugong dugong* Müller (Plate I). The animal photographed was caught by fishermen on Magalaua Island, near the town of Palauig, Zambales Province, Luzon, in June, 1913.

Captain Nicholson states that the flesh of the dugong is highly valued as food by the people of Zambales. The tusks, which Captain Nicholson kindly presented to the Bureau of Science, are of smooth hard ivory, slightly curved, and somewhat flattened on the inner surface; length, 164 millimeters; circumference at base, 93 millimeters. Captain Nicholson stated that these tusks were hidden in the skull and scarcely protruded into the mouth. This specimen was a female about 2 meters in length. It is believed that the dugong arrives on the coast of Zambales during May and remains for about one month.

Being desirous of finding out more about the habits of these animals, and of securing a living specimen for the Bureau of Science aquarium, I wrote to the senior inspector of constabulary at Iba and received the following reply:

IBA, ZAMBALES, December 24, 1913.

SIR: In answer to a communication from your office dated August 8th and addressed to Captain Nicholson, I have the honor to state that I visited, about two months ago, the Island of Magalaua, situated near the town of Palauig, this province, and where most of the sea cows are caught. I could, however, make no definite arrangements about catching one or two of their young. The people thought it might be done, but said it would be difficult, as the animals—the young—were large and did not live as long as an ordinary fish in the open air. They would set no price on the undertaking, but said they would have a meeting and let me know. Up to date nothing has been heard.

They could tell me very little about the habits of the animals, but thought they give birth along this coast. Said their eyes would undergo a transformation as soon as they enter the open air, but supposed the vision would return when they were put back into the water, if alive. They claim that the eye apparently turns, instantly, to flesh when exposed to the open air.

They are usually caught during the rainy season of the year.

Very respectfully,

JOHN L. F. THARP.

ILLUSTRATION

PLATE I

- FIG. 1. *Dugong dugong* Müller, a female on the beach.
2. *Dugong dugong* Müller, showing head and fore part of body.
3. Tusks of *Dugong dugong* Müller.

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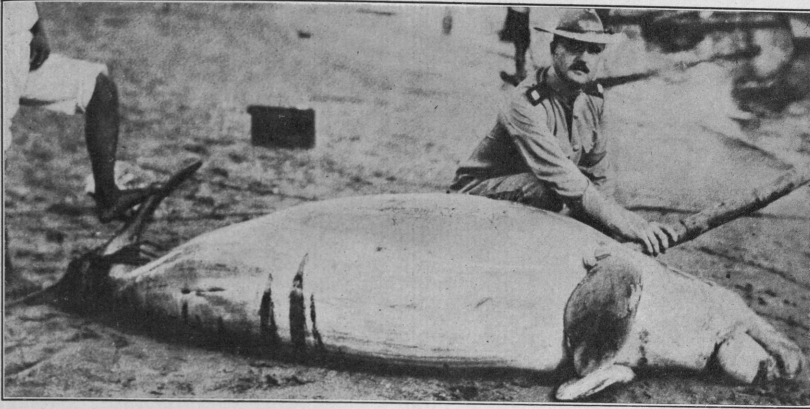


Fig. 1. A female dugong on the beach.

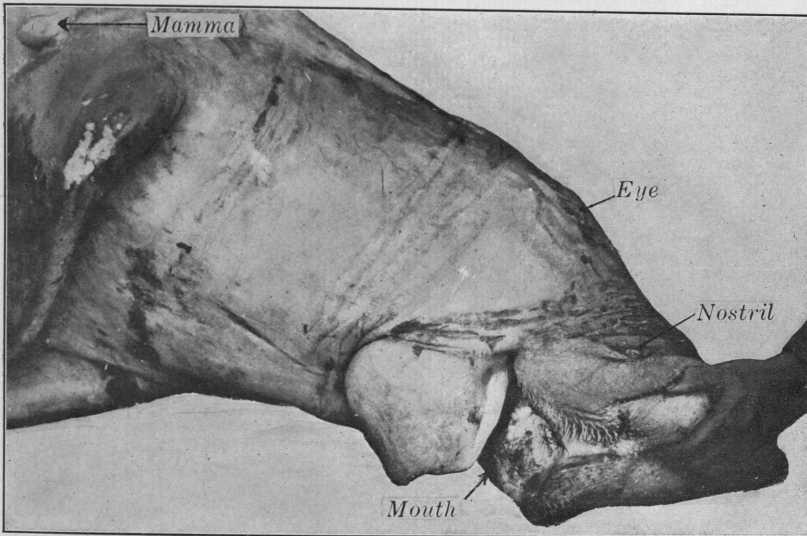


Fig. 2. Head and fore part of body of a dugong.



Fig. 3. The tusks of a dugong.

PLATE I.

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